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Impact of CO₂, contaminant gas, aqueous fluid, and reservoir rock interactions on the geologic sequestration of CO₂.

Lowering the costs of front-end processes in the geologic sequestration of CO₂ can dramatically lower the overall costs. One approach is to sequester less-pure CO₂ waste streams that are less expensive or require less energy to separate from flue gas, a coal gasification process, etc. The objective of this research is to evaluate the impacts of CO₂ itself, as well as an impure CO₂ waste stream, on geologic sequestration using reaction progress models, reactive transport simulators and analogous reactive transport experiments run in a plug flow reactor.

We have investigated two generic reservoir rock scenarios: a feldspathic sandstone and a mixed calcite/dolomite carbonate. Models and experiments reacted these rocks with aqueous fluids that were initially equilibrated with respect to supercritical CO₂ under anticipated disposal temperatures and pressures. The contaminant gases included H₂S and SO₂ and in our kinetic modeling we specifically accounted for acid catalysis of mineral dissolution reactions. Our modeling results with the sandstone reservoir rock suggested the possible formation of the mixed hydroxyl carbonate mineral dawsonite (NaAlCO₃(OH)₂). We are investigating this possibility by running closed system experiments in flexible gold bag reactors under conditions that should favor its formation. Our initial reactive transport experiments in the plug flow reactor will use sandstone from the Frio Fm (TX) and are designed to provide information useful in planning a CO₂ geologic sequestration pilot field project.

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